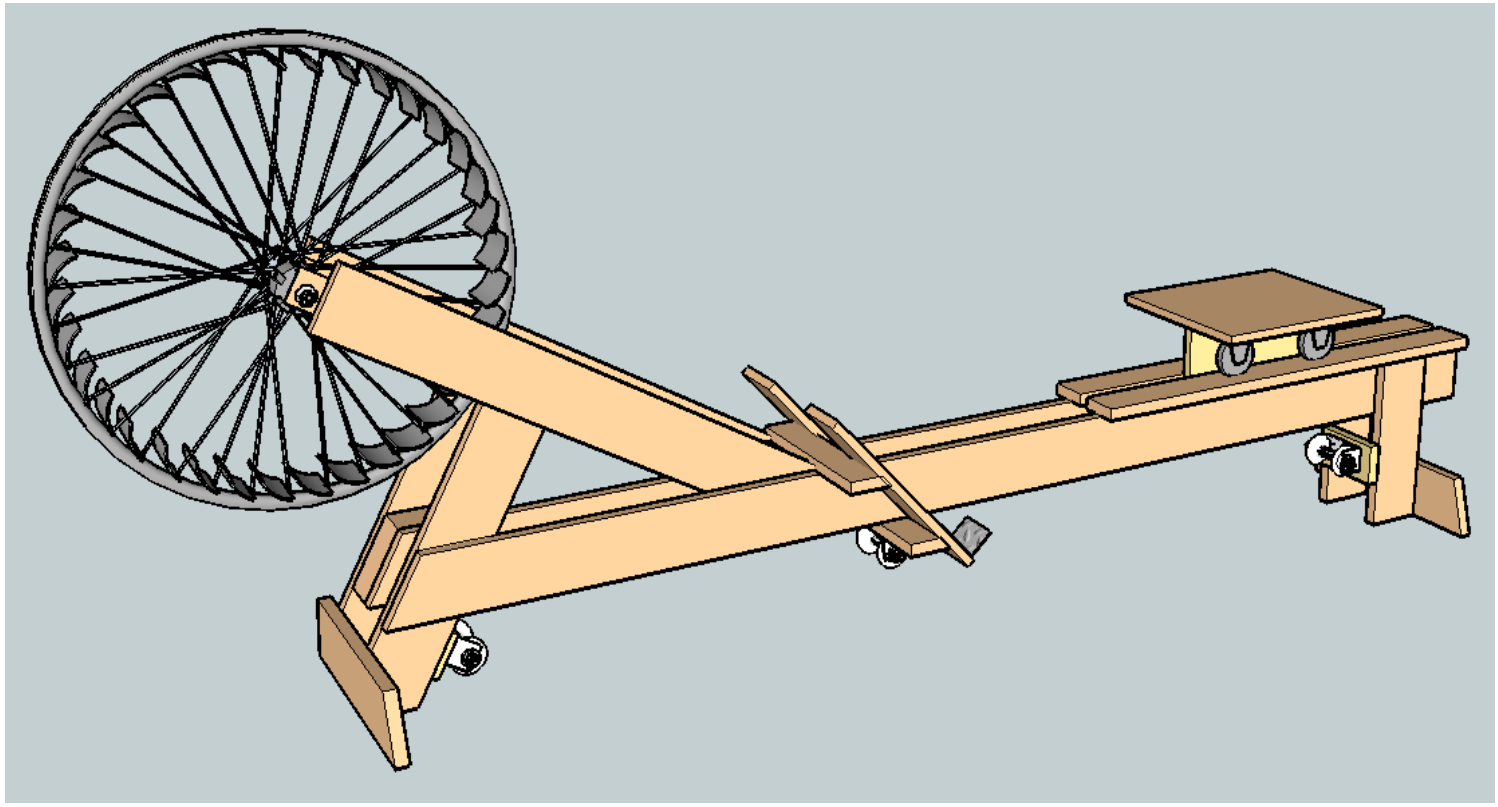
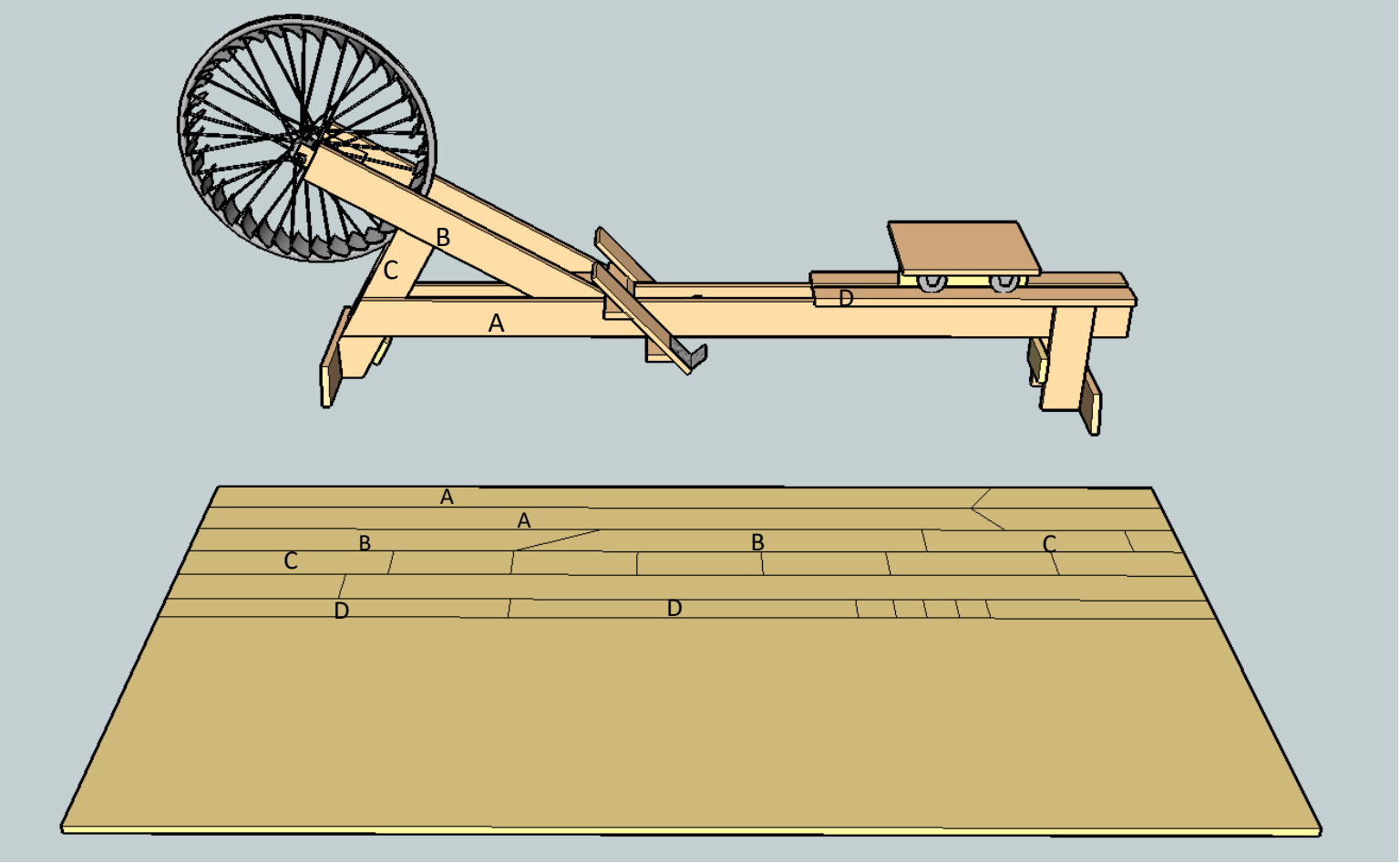
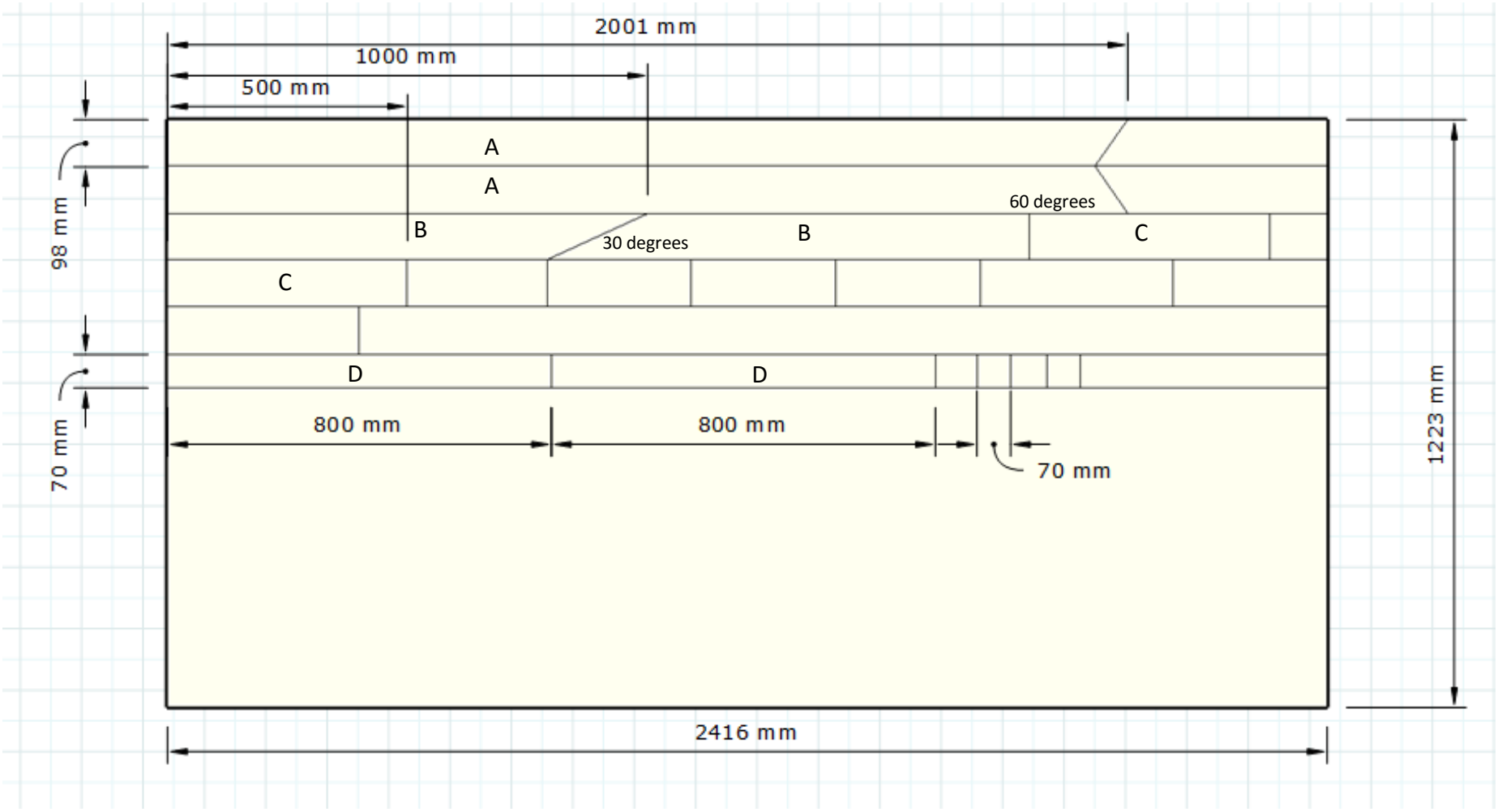
Openergo Mark 6 made in plywood



This one is for public use – so for safety, the impeller has a protective cover

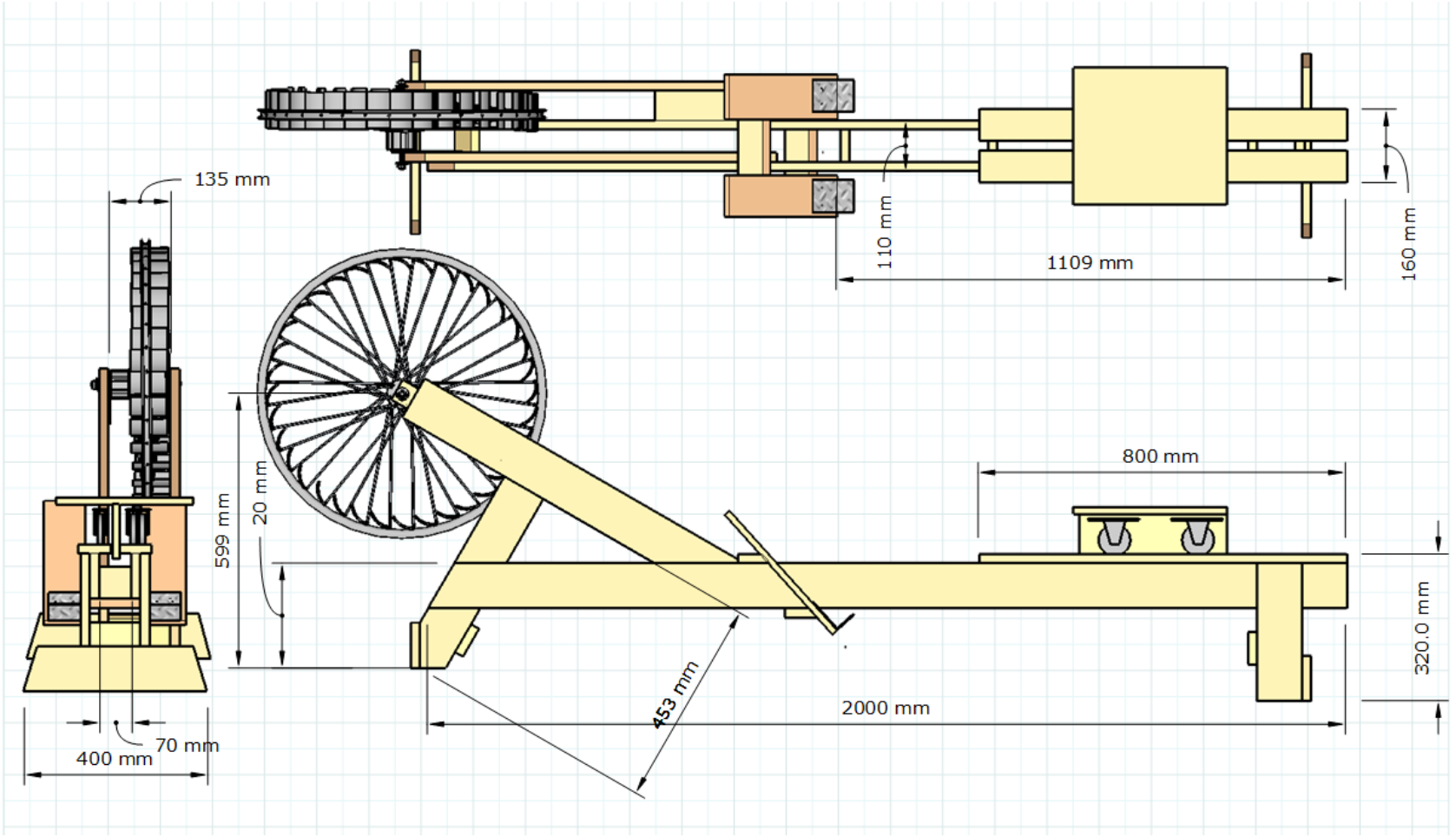
Main components cut from a 20mm thick sheet of 2440mm x 1220 plywood



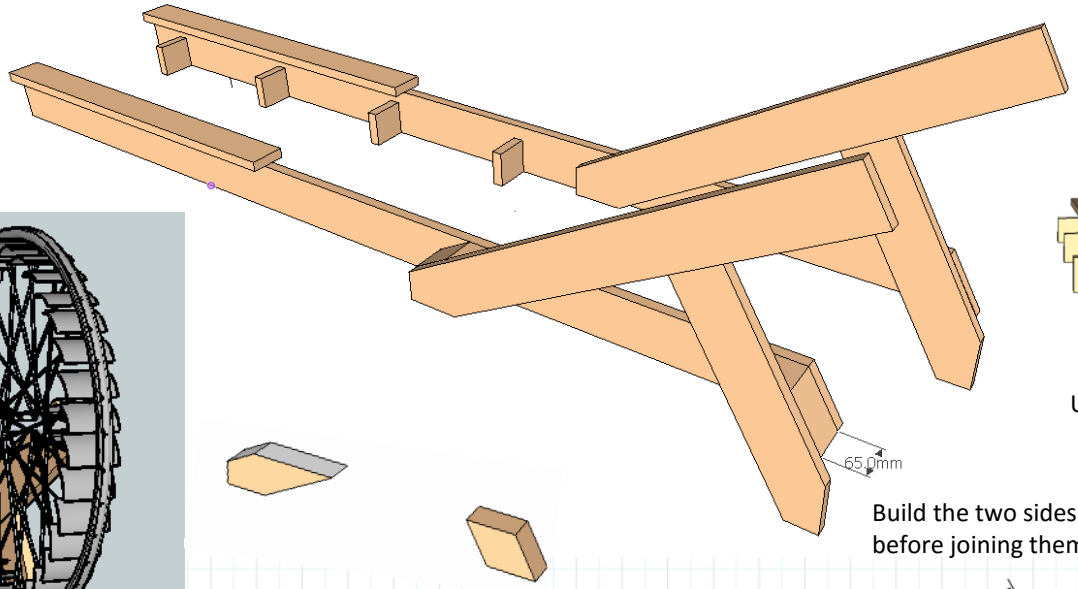


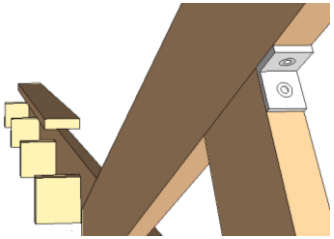
Tip: DIY stores such as B&Q will cut the strips to size at no additional charge

Main layout


135 mm
110 mm
1109 mm
160 mm
599 mm
20 mm
800 mm
320.0 mm
453 mm
2000 mm
70 mm
400 mm

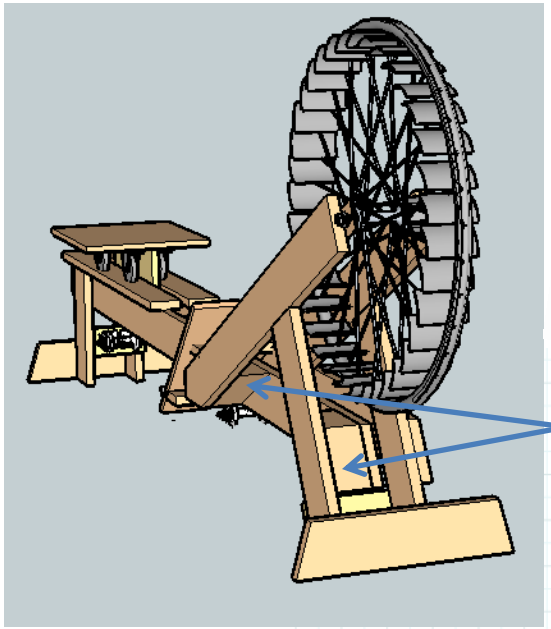
First stages of construction



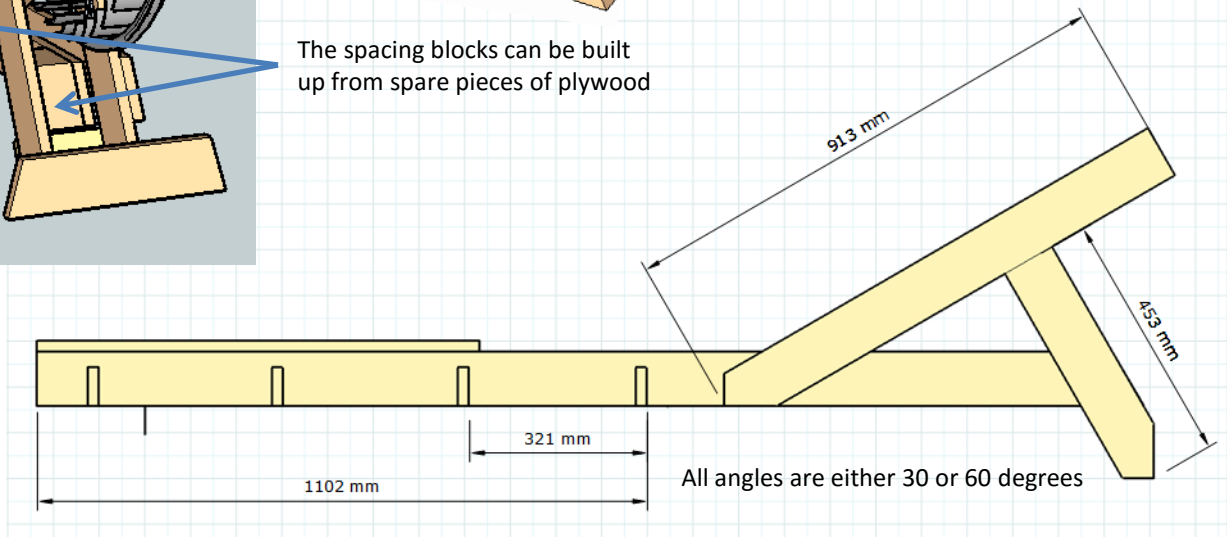


Use corner braces each side .

Build the two sides to this stage before joining them.



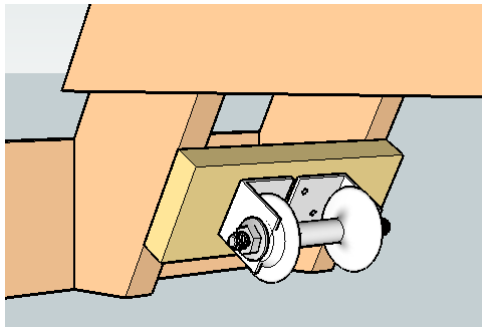
The spacing blocks can be built up from spare pieces of plywood

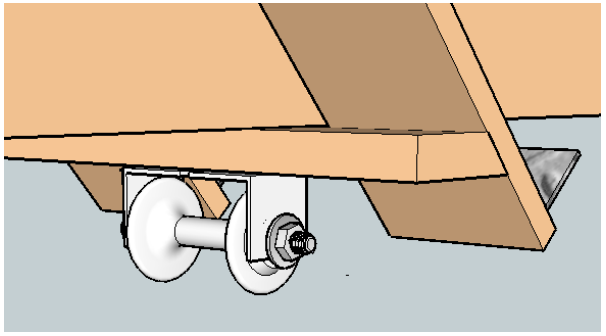


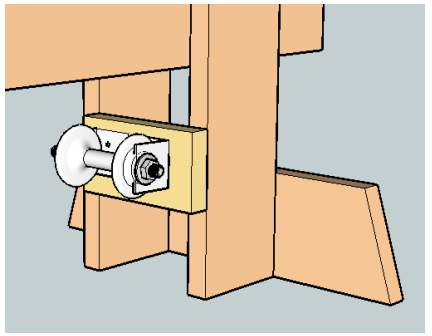
All angles are either 30 or 60 degrees

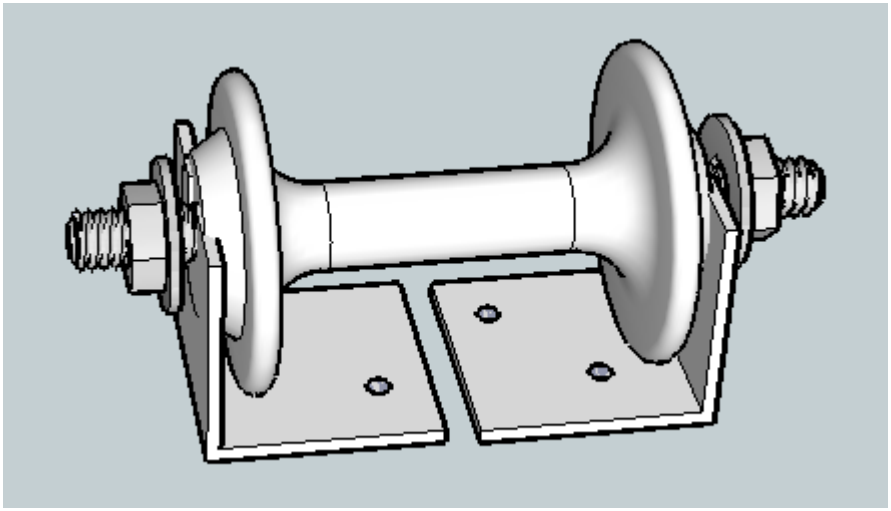
All joints are screwed and glued

The pulleys for the recoil system





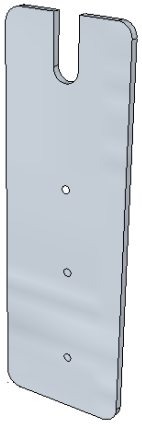


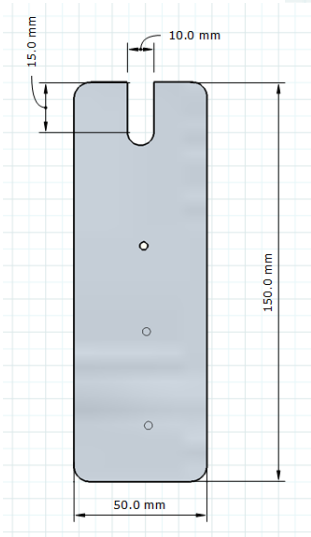


These units are made from spindle units salvaged from bike wheels and mounted on to brackets
My thanks to Jacob Owako in Kenya for this brilliant idea which can also be used for seat rollers. You can see Jacob using the ergo he built at https://www.youtube.com/watch?v=-Zqp12SNjHM

Bits and pieces

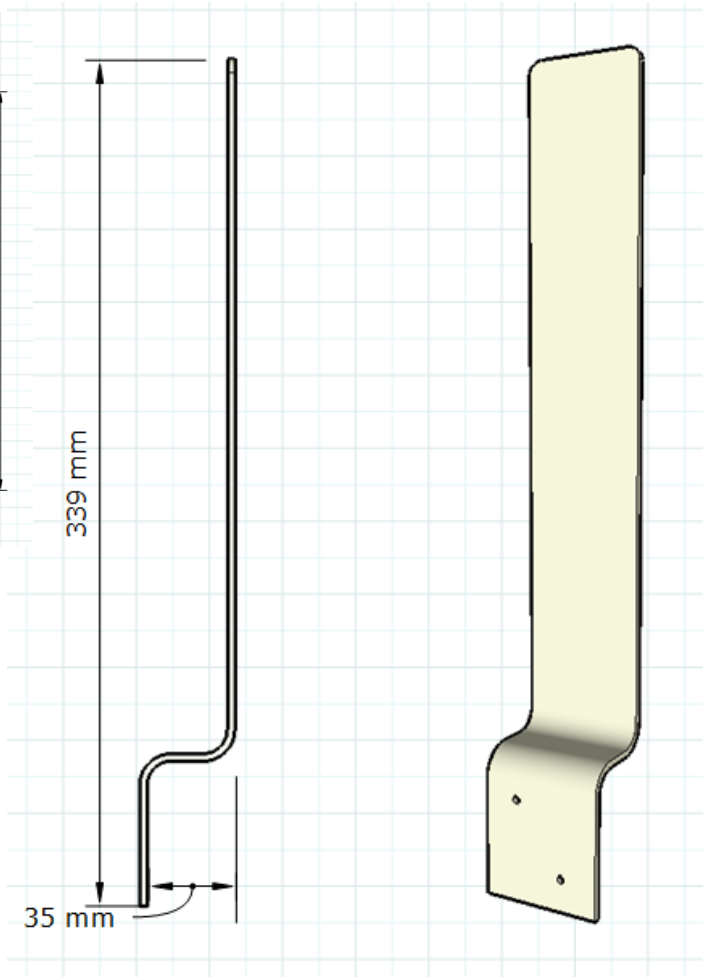
Fixed castors: Screwfix Product Code: 69497





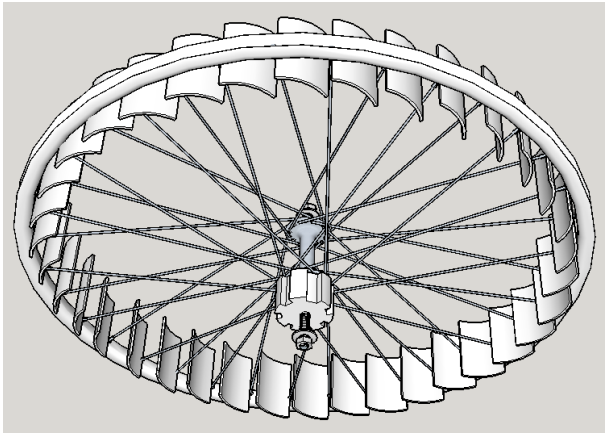
Two plates to carry the wheel spindle.
The hole for the spindle is 10mm dia.
Steel 2mm thick or aluminium 3mm thick.

Corner braces 25mm x 25mm:
Screwfix Product Code 11529

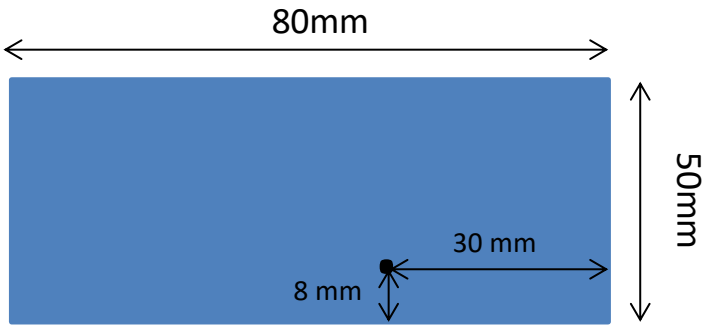


The deflector to prevent the rope, belt or chain from catching on the impeller. Steel 2mm thick or aluminium 3mm thick.

If you are in the UK, Screwfix is at http://www.screwfix.com
There will be similar suppliers in other countries where it is possible to buy components like these – or bits that can be adapted.



This impeller is more efficient and easier to make than the one used in previous models. The vanes are made from plastic guttering and held in place with self-tapping screws. Note the direction of rotation – which is clockwise as seen from this side



Clearance holes for the screws need to be drilled through the rim of the wheel 8mm in front of each spoke. 36 vanes are required so it is useful to use jigs to ensure uniformity. A starter hole for the fixing screw is best made with a nail – but only make a deep mark in the surface. The vanes are set asymmetrically to give clearance to the belt or rope. The can be symmetrical if using a chain with a large cassette.

Some of the details if a rope or belt drive is used instead of a chain

Note how a bracket is used to deflect the rope or belt around the freewheel unit. With one and a half turns around the free wheel the deflector for the rope is not required. The belt drive requires much more tension on the return system.

The defector protects the rope or belt from the impeller vanes

The rope drive needs one and a half turns around the wheel spline.

The freewheel unit with sprockets removed – specialist tools are needed

Most freewheel systems have a threaded collar to hold the sprockets in place.. This can be used to secure the washer.

The freewheel unit screws on to the wheel. This unit is 'stepped'. The straight ones are better

Chain drive – use the smallest sprocket.

The front pulley

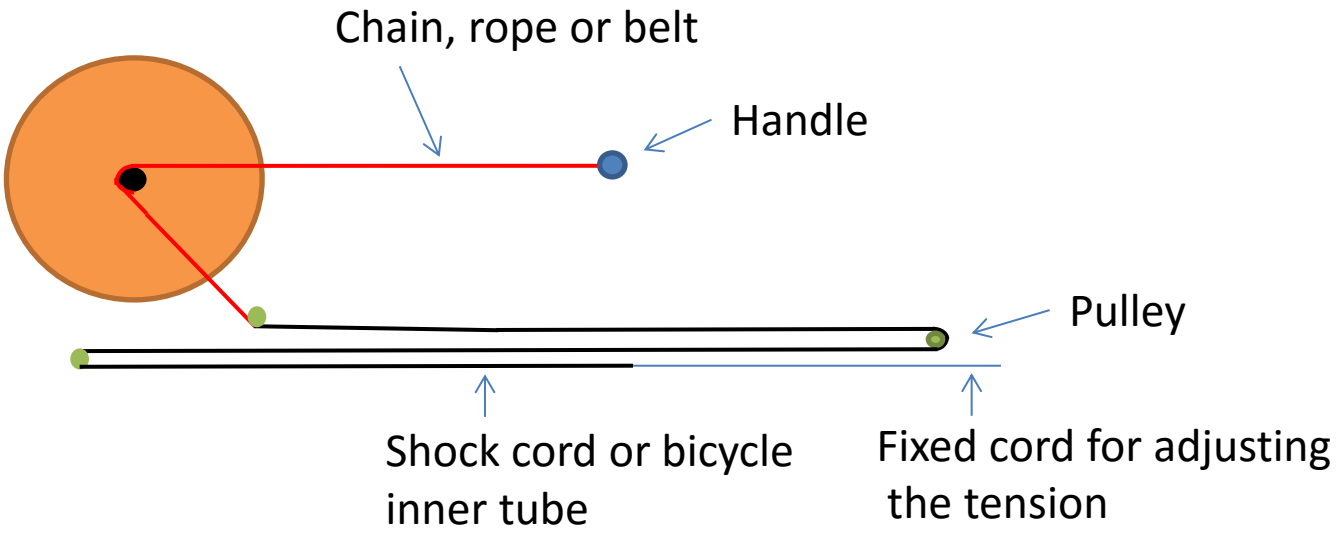
The rear pulley

The handle return action using a bicycle inner tube. The last piece of rope adjusts the tension

You might notice that these photographs show a Mark 4 frame – which was used as a test bed for the rope drive, the belt drive and an inner tube as an alternative to shock cord.

A Schematic diagram of the recoil system

At the furthest pull position of the handle, the chain/rope/belt must still be around the sprocket of the bicycle wheel.

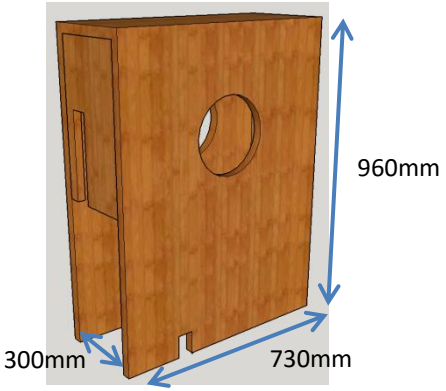


The shock cord or inner tube is tied to the end of the chain/rope/belt, then stretched around the pulley and tied to the frame. There must be sufficient pull on the shock cord so that the handle is pulled back quickly to the start of the stroke.
Note that with a rope drive, it will need two turns around the splines.

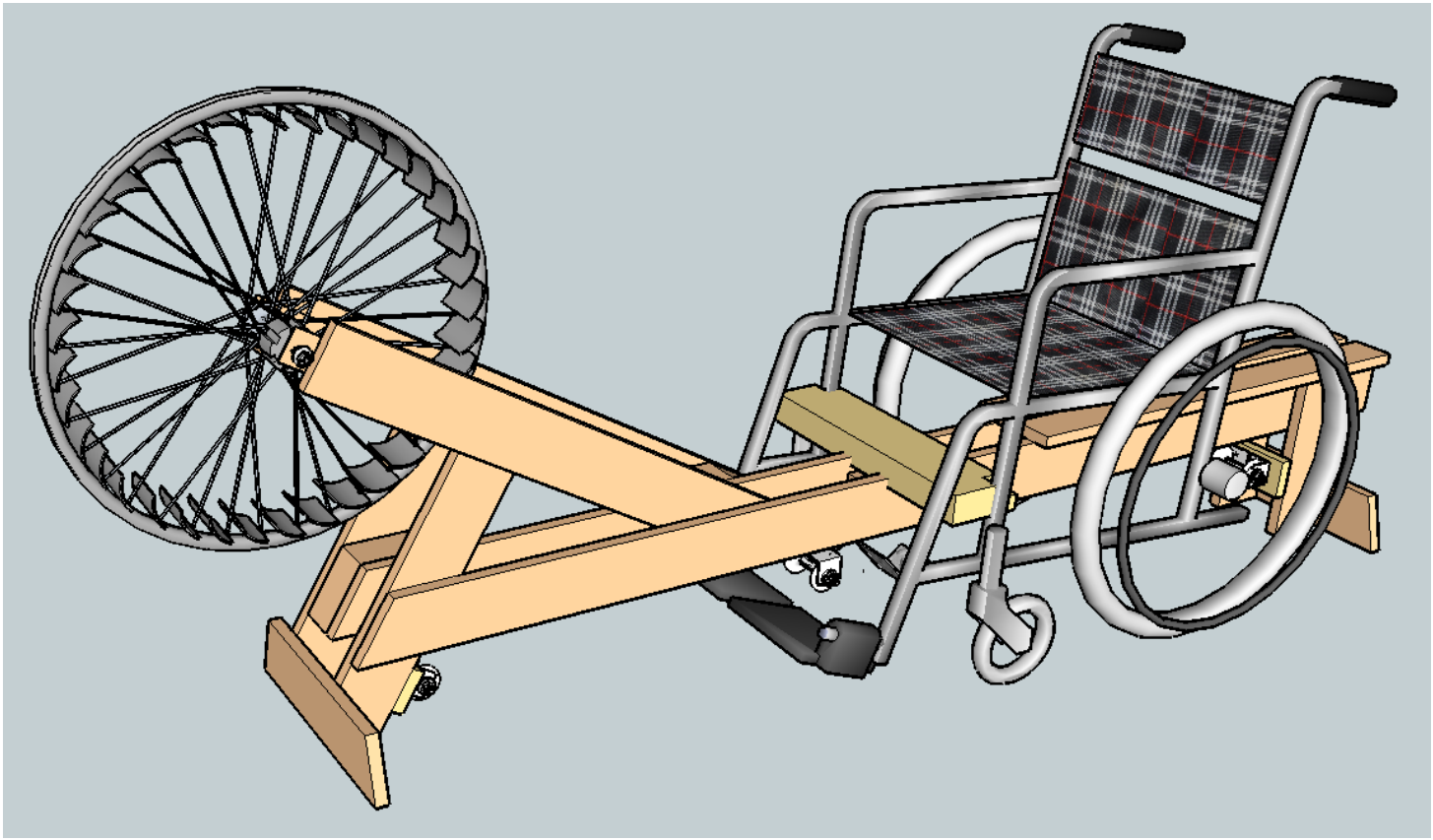
Making a protective cover for the impeller

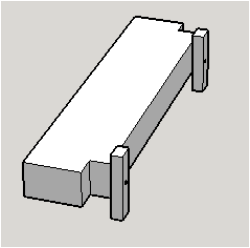
The impeller need a cover to prevent accidental contact with the impeller vanes. This could be a plywood box like the one shown below, or a cage made from weldmesh (http://www.meshdirect.co.uk/) .

One 'funky' solution is to use a car tyre to enclose the impeller. The one shown is a Michelin tyre with an outside diameter of 700mm and a width of 220mm. Most garages that fit tyres will give away scrap ones like this free of charge. Because of the steel wire and mesh belt embedded in the tread, cutting is only practicable with an angle grinder fitted with a disc for cutting metal – I wore out six cutting disks to achieve the effect above. Note the need for a supporting bracket to take the weight of the tyre.



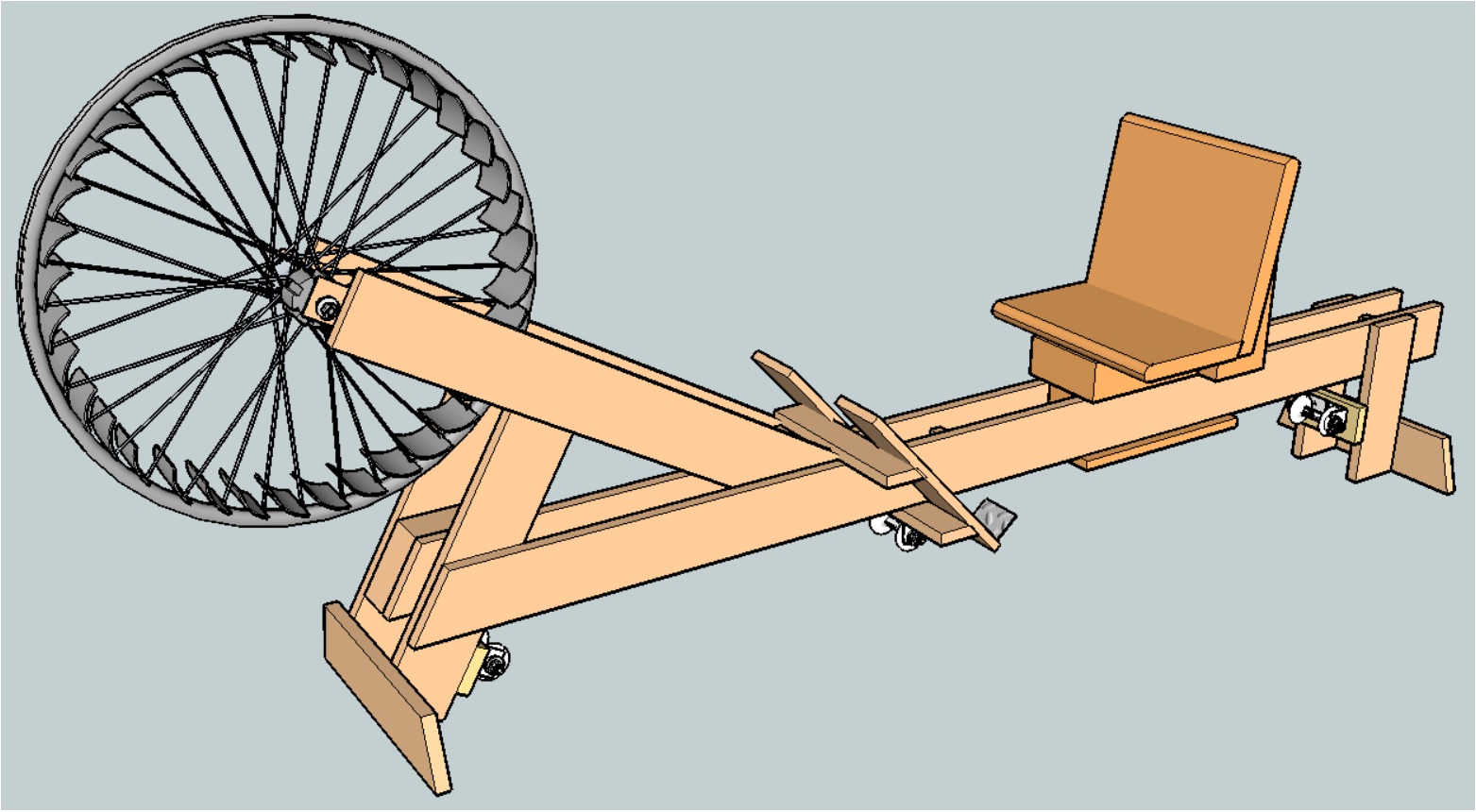
Adapted for a wheelchair athlete

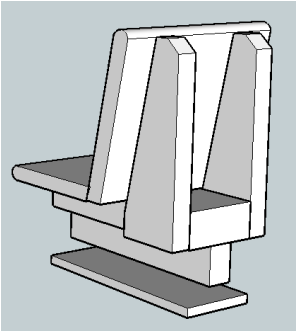




This is the additional component required (shown with the latches open) to fix the wheelchair in position. The dimensions need to fit the particular wheelchair but as a guide it will be about 410mm long. The centre of the wheelchair needs to be in line with the chain/rope/belt.

A fixed seat system for adaptive athletes





The dimensions of the seat need to be determined by the athletes using the machine. The lower plate is screwed to the main part to clamp the seat in the required position.

Notes

Previous models used a chain to drive the impeller and bungy (shock) cord for the return system – a works well if you have easy access to the necessary components.

Videos of previous models can be seen at http://openergo.webs.com/ also the instructions for each model are still available.

Videos of both the belt drive and the rope drive can be seen at http://youtu.be/AspYWV14CCE and http://youtu.be/QDughn4vRCc

If you would like copies of the Sketchup files so that you can examine the design in closer detail – just ask. A free trial of Sketchup can be downloaded at http://www.sketchup.com/ If you are in any form of education, a licence is freely provided.

This is an Open Source project so please contribute your ideas and send the details for inclusion on the website – also photographs and videos of the ergs you have made.

I want to encourage young entrepreneurs, either individually or in schools or youth organisations to set up a business to manufacture and sell these rowing machines.

I also want to encourage schools to use this machine as a basis for activities in Science, Technology, Engineering and Mathematics (STEM) – and also to encourage physical activity.

For any further information or questions, email me jimflood42@gmail.com